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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Nutritional Composition Containing Improved Dietary Nitrogen Component

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NUTRITIONAL COMPOSITION CONTAINING IMPROVED DIETARY NITROGEN COMPONENT

Background of the Invention

Various nutritional compositions have been formulated to provide partial or complete nutrition to patients suffering from a wide variety of ailments and conditions. Nutritional compositions for oral or enteral administration were typically prepared as a dry powder which is reconstituted with water before use, or prepared as a ready-to-use liquid. The compositions contained widely varying levels of carbohydrates, lipids,and proteins/amino acids as well as vitamins and minerals. The powder compositions were generally inconvenient to mix, use and maintain sterility, and the liquid compositions typically suffered from poor storage stability and would separate into phases over time.

ISOCAL is an enteral formulation by Mead Johnson which utilizes casein and soy for its protein source, glucose oligosacchrides for its carbohydrate source and soy oil and medium chain triglycerides (MCT) oil for its lipid source.

OSMOLITE is manufactured by Ross Labs and utilizes as its protein source casein and soy, corn starch for its carbohydrate source and fifty percent MCT oil, forty percent corn oil and ten percent soy oil for its lipid source.

ENSURE is manufactured by Ross Labs and utilizes casein and soy for protein source, corn starch and sucrose for a carbohydrate source and corn oil for a lipid source.

SUSTACAL manufactured by Mead Johnson utilizes casein and soy for its protein source, corn syrup and sucrose for its carbohydrate source and soy oil for its lipid source.

ENSURE PLUS manufactured by Ross Labs is a high protein, high calorie composition using soy and casein for its protein source, corn starch and glucose for its carbohydrate source and corn oil for its lipid source.

MAGNACAL manufactured by Sherwood Medical is a high density composition with 2.0 calories/ml. MAGNACAL utilizes casein for its protein source, corn syrup for its carbohydrate source and soy oil for its lipid source.

TRAUMACAL manufactured by Mead Johnson utilizes casein for its protein source, corn syrup and sucrose for its carbohydrate source and 70 percent soy bean oil and 30 percent MCT oil for its lipid source.

ISOTEIN HN is manufactured by Sandoz Nutrition Corporation and utilizes lactalbumin for its protein source, maltodextrin for its carbohydrate source and soy oil and MCT oil for its lipid source.

VIVONEX PLUS is manufactured by Sandoz Nutrition Corporation and comprises branched chain amino acids, glutamine, arginine, and other amino acids as the protein source, soybean oil as the lipid source, and maltodextrin and modified starch as the carbohydrate source.

IMPACT is manufactured by Sandoz Nutrition Corporation and comprises arginine and caseinates as the protein source, maltodextrins as the carbohydrate, and menhaden oil and structured lipids as the lipids source.

REABILIN HN available from Clintec Nutrition Company has a caloric distribution of 17.5% peptides (whey, casein and non-phosphorylated casein) 35% lipids (medium chain triglycerides) and 47.5% carbohydrates (maltodextrins and starch).

CRITICARE HN available from Mead-Johnson has a caloric distribution of 14% peptides (casein hydrolysate), 4.5% lipid (safflower oil and polyglycerol esters of fatty acids), and 81.5% carbohydrate (maltodextrin and modified corn starch).

U.S. Patent No. 3,697,287 describes an amino acid food composition in the form of an aqueous emulsion containing amino acids, carbohydrates, fats and minerals and vitamins. U.S. Patent No. 4,670,268 describes an enteral nutritional formula having a caloric distribution of 8-20% protein hydrolysate, 35-55% lipids and 35-60% carbohydrates. U.S. Patent No. 4,414,238 describes a liquid elemental diet having a caloric distribution of 5-30% amino acids, 10-50% lipids and 50-90% carbohydrates.

U.S. Patent No. 5,053,387 describes enteral compositions for treating traumatic injury comprising an intact protein (from lactalbumin egg albumen or whey and the like), arginine, carbohydrate (glucose polymers, disaccharides, starches and the like), lipid comprising omega-3 fatty acids of fish oil, and necessary vitamins and minerals.

U.S. Patent No. 5,231,085 describes enteral compositions comprising arginine, ornithine, a nucleobase, omega-3 polyunsaturated fatty acids, and omega-6 polyunsaturated fatty acids.

The present invention overcomes many of the deficiencies in prior art nutritional compositions by providing a liquid nutritional composition which supplies complete nutrition to metabolically stressed human patients, has improved digestion and absorption, and exhibits improved emulsion and storage stability.

MMARY OF THE INVENTION

The present invention r lates to an improved liquid nutritional composition comprising, for oral or enteral administration to a human subject:

(a) a carbohydrate component which comprises from 50 to 75% of the total caloric content of said composition;

(b) a lipid component which comprises from 10 to 20% of the total caloric content of said composition; and

(c) a dietary nitrogen component which comprises from 15 to 25% of the total caloric content of said composition, wherein said dietary nitrogen component comprises from 20 to 30% by weight free amino acids, from 60 to 75% by weight hydrolyzed casein, and from 5 to 15% by weight intact caseinate protein, based on total weight of said dietary nitrogen component.

The nutritional compositions exhibit long-term emulsion and storage stability and provide complete nutrition for critically ill or other metabolically-stressed patients. The nutritional compositions are particularly useful for the management of patients with maldigestion and malabsorption and other related medical conditions.

DETAILED DESCRIPTION

Improved liquid nutritional compositions are provided by this invention which have long-term emulsion and storage stability and are useful in providing nutrition to a metabolically-stressed human subject. The nutritional compositions of this invention are particularly useful in providing complete nutrition to metabolically-stressed patients who are suffering from maldigestion, malabsorption, or who are otherwise gastro-

intestinally compromised, such as those being treated for trauma, surgery, irradiated bow l, pancreatitis, inflammatory bowel disease, or post operative malnutrition. The nutritional compositions of the invention are administered orally or enterally and provide an improved dietary nitrogen component, which results in improved digestion and adsorption.

The liquid nutritional compositions of the present invention comprise:

(a) a carbohydrate component which comprises from 60 to 75% of the total caloric content of said composition;

(b) a lipid component which comprises from 10 to 20% of the total caloric content of said composition; and

(c) a dietary nitrogen component which comprises from 15 to 25% of the total caloric content of said composition, wherein said dietary nitrogen component comprises from 20 to 30% by weight free amino acids, from 60 to 75% by weight hydrolyzed casein, and from 5 to 15% by weight intact caseinate protein, based on total weight of said dietary nitrogen component.

The carbohydrate component of the nutritional compositions of this invention comprise from 60 to 75% of the total caloric content of the composition; more pref rably 65 to 70%, most preferably about 65%. These carbohydrate component can cons'st of any of the typical dietary carbohydrates used in nutritional compositions. Thus carbohydrates can include starches, dextrins, maltodextrins, glucose, fructose, sucrose, and the like. Preferred carbohydrates are the maltodextrins or low molecular weigh: hydrolyzed cornstarch.

The lipid component of the nutritional composition comprise from 10 to 20% of

the total caloric content of the composition; more preferably 15 to 20%; most preferably about 15%. The lipid component can consist of any of the fat, oils or lipid sources conventionally used in nutritional compositions and ar available from a variety of animal, plant and synthetic sources. The lipid component preferably comprises about 26% polyunsaturated fat, about 11% monounsaturated fat, and about 63% saturated fat based on total weight of said lipid sources conventionally used in nutritional compositions component. The preferred lipid component for use in the compositions of this invention comprises a mixture of medium chain triglycerides (i.e., containing C_8-C_{12} fatty acids) and vegetable oil (particularly soybean oil). The most preferred lipid component comprises about 3% linolenic acid and about 22% linoleic acid based on total weight of said lipid component. The preferred ratio of omega-6 fatty acids to omega-3 fatty acids is about 7:1.

The dietary nitrogen component of the compositions of this invention comprise from 15 to 25% of the total caloric content of the composition; more preferably 20 to 25%; most preferably about 20%. The dietary nitrogen component comprises from 20 to 30% by weight free amino acids, from 60 to 75% by weight hydrolyzed casein, and from 5 to 15% by weight intact (i.e., non-hydrolyzed) caseinate protein, all based on total weight of the dietary nitrogen component. More preferably, the dietary nitrogen component comprises about 26% by weight free amino acids, about 65% by weight hydrolyzed casein; and about 9% by weight intact caseinate protein.

The free amino acids include the essential and non-essential amino acids as well as simple reaction products of these amino acids, such as esters, amides and salts of amino acids. The free amino acids preferably comprise 25 to 35% by weight branched-chain amino acids, more preferably about 30%. The free amino acids comprise, based on total weight of said free amino acids:

• L-Histidine -	6-7%; preferably about 6.3%
L-Isoleucine -	7-8%; preferably about 7.5%
L-Leucine -	14-16%; preferably about 15.0%
L-Lysine -	6-7%; preferably about 6.3%
• L-Methionine/ L-Cystine -	3-5%; preferably about 3.9%
• L-Phenylalanine/L-Tryptophan -	8-9%; preferably about 8.2%
L-Threonine -	3-4%; preferably about 3.3%
L-Tyrosine -	0.5-1.5%; preferably about 1.0%
L-Valine -	7-8%; preferably about 7.5%
L-Alanine -	2-3%; preferably about 2.4%
L-Arginine -	9-11%; preferably about 10.0%
L-Aspartic Acid -	5-6%; preferably about 5.7%
• L-Glutamine/L-Glutamic Acid -	18-19%; preferably about 18.6%
Glycine -	1-2%; preferably about 1.4%
L-Proline -	8-9%; preferably about 8.4%
L-Serine -	4-5%; preferably about 4.6%
TOTAL	100%

• (preferably comprises a 1:1 mixture; but can vary from 1:99 to 99:1).

In a preferred embodiment of the nutritional compositions of this invention, the hydrolyzed casein has a degree of hydrolysis of 25 to 35% and a pH of 6.8 to 7.2. In another preferred embodiment the dietary nitrogen component comprises L-arginine at a level providing about 2% of the total caloric content of the nutritional composition.

The nutritional compositions of the invention preferably have a ratio of grams of nitrogen:calories of about 1:125, and a ratio of grams of nitrogen to non-nitrogen calories of about 1:100. Vitamins and minerals may be added to the nutritional compositions of this invention to meet the U.S. Recommended Daily Allowances or other medically-indicated requirements. Additional ingredients conventionally used in

nutritional compositions may optionally be added to the compositions of the present invention provided that, the levels of critical components described herein are met. These optional ingredients can include fiber, sweetening agents, flavoring agents, coloring agents, emulsifiers, anti-foaming agents, stabilizers and the like.

The nutritional compositions are useful in providing complete nutrition to metabolically-stressed human patients. The nutritional compositions are especially useful in providing complete semi-elemental nutrition to patients who are gastro-intestinally compromised due to surgery, trauma, irradiated bowel, fistula, partial obstruction, short bowel syndrome, and the like. The compositions are administered orally or enterally as a ready-to-use aqueous emulsion to provide about 1500 to 2000 calories per day.

The present nutritional compositions can be prepared by mixing or blending the ingredients using conventional techniques to form an aqueous emulsion. The final nutritional composition is preferably sterilized by one or more heat treatment steps and sealed in an aseptic container. The heat treatment step preferably comprises heating the composition to about 100°C or greater for about 20 minutes or longer. The nutritional compositions of the invention exhibit improved long-term emulsion and storage stability, even after being subjected to heat treatment.

The following examples are presented to help demonstrate the present invention. The examples are intended to be illustrative and not limitative. The present invention includes the embodiments described and exemplified herein, as well as equivalent embodiments.

EXAMPLE I

A composition within the scope of this invention was prepared having the formulation presented in Table I below:

TABLE I

	%
DEIONIZED WATER	78.31184
HYDROLYZED CORNSTARCH	15.66936
CASEIN HYDROLYSATE	3.86737
MEDIUM CHAIN TRIGLYCERIDES	0.90625
SOYBEAN OIL	0.60957
SODIUM CASEINATE	0.45831
POTASSIUM CITRATE	0.40056
L-ARGININE	0.31418
L-LEUCINE	0.30683
CALCIUM PHOSPHATE TRIBASIC	0.15766
L-ISOLEUCINE	0.14910
CELLULOSE GEL	0.12599
L-VALINE	0.09896
SODIUM ASCORBATE	0.09052
CITRIC ACID	0.08948
HYDROXYLATED SOY LECITHIN	0.07940
MAGNESIUM CHLORIDE	0.07716
L-METHIONINE	0.07492
SODIUM CITRATE	0.03176
CALCIUM CARRAGEENAN	0.03176
CHOLINE CHLORIDE	0.03131
L-TRYPTOPHAN	0.02654
TAURINE	0.02223
CELLULOSE GUM	0.02223
POTASSIUM CHLORIDE	0.01667
L-CARNITINE	0.00926
ZINC SULFATE	0.00299
NIACINAMIDE	0.00278
FERROUS SULFATE	0.00275
CALCIUM PANTOTHENATE	0.00183
COPPER GLUCONATE	0.00062
MANGANESE SULFATE	0.00049
PYRIDOXINE HYDROCHLORIDE	0.00037
THIAMINE HYDROCHLORIDE	0.00034
BETA CAROTENE	0.00030
VITAMIN A PALMITATE	0.00028
RIBOFLAVIN	0.00024
BHA/BHT	0.00012
FOLIC ACID	0.00006
CHROMIC ACETATE	0.000042
BIOTIN	0.000041
SODIUM MOLYBDATE	0.000031
ALPHA TOCOPHERYL ACETATE	0.000031
POTASSIUM IODIDE	0.000013
SODIUM SELENITE	0.000013
PHYTONADIONE (VITAMIN K1)	0.000008
CYANOCOBALAMIN (VITAMIN B12)	0.000001
CHOLECALCIFEROL (VITAMIN D3)	0.000001

The composition was prepared as follows:

Under agitation, the sodium caseinate and half of the antifoam ingredient is added to a first tank containing deionized water. After 15 minutes, the temperature is increased to 140°F and the agitation speed is reduced. This mixture is held at 140°F for 1 to 2 hours.

Microcrystalline cellulose, carrageenan and the balance of the antifoam ingredient are added to a second tank containing deionized water at 110-120°F. This mixture is agitated for 15 minutes minimum before making any other additions. While maintaining the second tank at 120°F, the following ingredients are added in the following order: free amino acids, citric acid, sodium citrate, potassium citrate, tricalcium phosphate and maltodextrin.

The MCT oil and the soybean oil are mixed and agitated and heated to 165°F in a third tank. Then hydroxylated lecithin is added to the third tank and mixed with moderate agitation. This mixture is then added to the second tank. The chlorides are dissolved in deionized water and added to the second tank. Maltodextrin is added to the second tank, followed by the addition of the vitamins and minerals dissolved in deionized water.

The sodium caseinate solution from the first tank is added to the second tank and homogenization is started by passing the mixture from the second tank through a homogenizer using the following conditions:

Feed pressure	20-30 psi
Feed temperature	120°F
Second stage pressure	500 psi
First stage pressure	3000 psi

The composition is passed through a second homogenizer using the same conditions as stated above. Following homogenization, the composition is passed through a heat exchanger, reducing the temperature of the composition to 40-45°F. The composition is then transferred to a holding tank wherein the sodium ascorbate (dissolved in deionized water) is added and mixed to form the final nutritional composition.

Example II

The composition prepared in Example I was evaluated for emulsion and storage stability and compared to two commercial nutritional compositions - REABILAN HN (available from Clintec Nutrition Co.) and CRITICARE HN (available from Mead Johnson). REABILIN HN has a caloric distribution of 17.5% peptides, 35% lipid, and 47.5% carbohydrate and contains the following ingredients: water, maltodexrins, tapioca starch, medium chain triglycerides (fractionated coconut oil), whey peptides, casein peptides, non- phosphorylated casein peptides, oenothera biennia oil, soya oil, soya lecithin, glyceryl monostearate, magnesium oxide, inositol, calcium chloride, taurine, choline chloride, calcium ascorbate, sodium chloride, ferrous sulphate, zinc sulphate, potassium dihydrogenphosphate, nicotinamide, alpha tocopherol acetate, sodium alginate, manganese sulphate, calcium pantothenate, copper sulphate, pyridoxine hydrochloride, thiamine hydrochloride, riboflavin, vitamin A palmitate, chromium chloride, folic acid, sodium selenite, biotin, potassium iodide, phylloquinone, cyanocobalamin, cholecalciferol, potassium hydroxide, citric acid, and potassium chloride.

CRITICARE HN has a caloric distribution of 4.5% lipid, 14% peptide, and 81.5% carbohydrate and contains the following ingredients: water, maltodextrin, casein hydrolysate, modified corn starch, safflower oil, calcium glycerophosphate, polyglycerol esters of fatty acids, carrageenan, and less than 2% of each of the following: vitamins (vitamin A palmitate, cholecalciferol di-alpha-tocopheryl acetate, sodium ascorbate, folic acid, thiamin hydrochloride, riboflavin, niacinamide, pyridoxine hydrochloride,

cyanocobalamin, biolin, calcium pantothenate, phylonadione, choline bitartrate), minerals (calcium gluconate, potassium iodide, ferrous gluconate, magnesium oxid , copper gluconate, zinc gluconate, manganese gluconate, potassium citrate, magnesium chloride), L-methionine, L-tyrosine, and L-tryptophan.

All samples were stored in 1.0 liter oxygen barrier plastic bottles. The competitive products were aseptically transferred to 1.0 liter oxygen barrier bottles, sealed, shaken, and stored undisturbed at room temperature. This set of samples received one thermal process - that provided by the supplier. These products were compared to the current inventive composition if Ex. I which was filled into 1.0 liter bottles and thermally processed at 262°F for 20 minutes. All of these samples are designated as "single process" samples.

Another set of 1.0 liter bottles were filled with competitive product, sealed, and thermally processed at 262°F for 20 minutes. The composition of Ex.I was thermally processed twice at 262°F for 20 minutes. This set of samples essentially received two thermal processes and are designated "double process" samples.

The samples were each shaken and held for various periods of time and visually inspected for emulsion stability. The emulsion stability of the various compositions is shown in Table 2 below.

TABLE 2

		Emulsion Stability Rating		
Storage Time	Heat Treatment Process	Comp. of Ex. I	Reabilan HN	Criticare HN
18 hours	Single process	5[A]	5[B]	1
	Double Process	5[C]	1-2[D]	1[D]
24 hours	Single process	5[A]	3[B]	1[B]
	Double process	5[C]	1[D]	1[D]
1 week	Single process	5[A]		1[B]
	Double process	5[C]	1[D]	1[D]
2 weeks	Single process	5[A]		1[B]
	Double process	5[C]	1[D]	1[D]
6 months	Single process	3[A]	1[B]	1[B]
	Double process	3[C]	1[D]	1[D]

[A]Product sterilized at 262°F, 20 minutes in 1.0 L plastic bottle.
[B]Product commercially sterilized by manufacturer. Aseptically transferred to 1.0 L plastic bottles.
[C]Product sterilized twice at 262°F, 20 minutes in 1.0 L plastic bottle.
[D]Product commercially sterilized by manufacturer. Transferred to 1.0 L plastic bottles and thermally processed once at 262°F, 20 minutes

Rating:

5 - No phase separation. Uniform color. Unchanged from original composition.
4 - Faint fat line on surface, no flocculation
3 - Slight flocculation in continuous phase or more pronounced fat layer on surface
2 - Slight phase separation; unclear distinction between opaque and clear layers
1 - Distinct phase separation, major flocculation or clear fat layer on surface

CLAIMS

1. A liquid nutritional composition comprising, for oral or enteral administration to a human subject,

(a) a carbohydrate component which comprises from 60 to 75% of the total caloric content of said composition;

(b) a lipid component which comprises from 10 to 20% of the total caloric content of said composition; and

(c) a dietary nitrogen component which comprises from 15 to 25% of the total caloric content of said composition, wherein said dietary nitrogen component comprises from 20 to 30% by weight free amino acids, from 60 to 75% by weight hydrolyzed casein, and from 5 to 15% by weight intact caseinate protein, based on total weight of said dietary nitrogen component.

2. The nutritional composition of claim 1 wherein said carbohydrate component comprises 65 to 70% of the total caloric content of said composition.

3. The nutritional composition of claim 1 wherein said carbohydrate component comprises about 65% of the total caloric content of said composition.

4. The nutritional composition of claim 1 wherein said lipid component comprises from 15 to 20% of the total caloric content of said composition.

5. The nutritional composition of claim 1 wherein said lipid component comprises about 15% of the total caloric value.

6. The nutritional composition of claim 1 wherein said lipid component comprises a mixture of medium chain triglycerides and soybean oil.

7. The nutritional composition of claim 1 wherein said lipid component comprises about 26% polyunsaturated fat, about 11% monounsaturated fat, and about 63% saturated fat based on total weight of said lipid component.

8. The nutritional composition of claim 1 wherein said lipid component comprises about 3% linolenic acid and about 22% linoleic acid based on total weight of said lipid component.

9. The nutritional composition of claim 1 wherein said dietary nitrogen component comprises 20 to 25% of the total caloric content of said composition.

10. The nutritional composition of claim 1 wherein said dietary nitrogen component comprises about 20% of the total caloric content of said composition.

11. The nutritional composition of claim 1 wherein said dietary nitrogen component comprises about 26% by weight free amino acids, about 65% by weight hydrolyzed casein, and about 9% by weight intact caseinate protein.

12. The composition of claim 1 wherein said hydrolyzed casein has a degree of hydrolysis of 25 to 35%.

13. The nutritional composition of claim 12 wherein said hydrolyzed casein has a pH of 6.8 to 7.2.

14. The nutritional composition of claim 1 wherein said free amino acids comprise 25 to 35% by weight branched-chain amino acids.

15. The nutritional composition of claim 14 wherein said free amino acids comprise about 30% by weight branched-chain amino acids.

16. The nutritional composition of claim 1 wherein said dietary nitrogen component comprises arginine at a level providing about 2% of the total caloric content of said composition.

17. The nutritional composition of claim 1 wherein the ratio of grams of nitrogen:calories is about 1:125.

18. The nutritional composition of claim 17 wherein the ratio of grams of nitrogen to non-nitrogen calories is about 1:100.

19. The nutritional composition of claim 1 wherein said free amino acids comprises about, based on total weight of said free amino acids:

L-Histidine	6-7%
L-Isoleucine	7%
L-Leucine	14-16%
L-Lysine	6-7%
L-Methionin /L-Cystine	3-5%
L-Phenylalanine/L-Tryptophan	8-9%
L-Threonine	3-4%
L-Tyrosine	0.5-1.5%
L-Valine	7-8%
L-Alanine	2-3%
L-Arginine	9-11%
L-Aspartic Acid	5-6%
L-Glutamine/L-Glutamic Acid	18-19%
Glycine	1-2%
L-Proline	8-9%
L-Serine	4-5%
TOTAL	100%

20. The nutritional composition of claim 1 wherein said composition has been sterilized by heat treatment and sealed in an aseptic container.

21. The nutritional composition of claim 20 wherein said heat treatment comprising heating said composition to about 100°C or greater for about 20 minutes or longer.

22. The nutritional composition of claim 1 wherein said composition is in the form of a stable, aqueous emulsion.

23. The nutritional composition of claim 20 wherein said composition is in the form of a stable, aqueous emulsion.

24. The nutritional composition of claim 1 wherein said composition comprises, based on weight percent:

	%
DEIONIZED WATER	76.31164
HYDROLYZED CORNSTARCH	15.66936
CASEIN HYDROLYSATE	3.86737
MEDIUM CHAIN TRIGLYCERIDES	0.90825
SOYBEAN OIL	0.60957
SODIUM CASEINATE	0.45831
POTASSIUM CITRATE	0.40056
L-ARGININE	0.31419
L-LEUCINE	0.30553
CALCIUM PHOSPHATE TRIBASIC	0.15765
L-ISOLEUCINE	0.14910
CELLULOSE GEL	0.12569
L-VALINE	0.09856
SODIUM ASCORBATE	0.09052
CITRIC ACID	0.08948
HYDROXYLATED SOY LECITHIN	0.07940
MAGNESIUM CHLORIDE	0.07716
L-METHIONINE	0.07492
SODIUM CITRATE	0.03176
CALCIUM CARRAGEENAN	0.03176
CHOLINE CHLORIDE	0.03131
L-TRYPTOPHAN	0.02654
TAURINE	0.02223
CELLULOSE GUM	0.02223
POTASSIUM CHLORIDE	0.01687
L-CARNITINE	0.00925
ZINC SULFATE	0.00259
NIACINAMIDE	0.00278
FERROUS SULFATE	0.00275
CALCIUM PANTOTHENATE	0.00183
COPPER GLUCONATE	0.00082
MANGANESE SULFATE	0.00049
PYRIDOXINE HYDROCHLORIDE	0.00037
THIAMINE HYDROCHLORIDE	0.00034
BETA CAROTENE	0.00030
VITAMIN A PALMITATE	0.00028
RIBOFLAVIN	0.00024
BHA/BHT	0.00012
FOLIC ACID	0.00005
CHROMIC ACETATE	0.000042
BIOTIN	0.000041
SODIUM MOLYBDATE	0.000031
ALPHA TOCOPHERYL ACETATE	0.000031
POTASSIUM IODIDE	0.000013
SODIUM SELENITE	0.00001
PHYTONADIONE (VITAMIN K1)	0.000008
CYANOCOBALAMIN (VITAMIN B12)	0.000001
CHOLECALCIFEROL (VITAMIN D3)	0.000001

25. A method for providing nutrition to a metabolically-stressed human subject comprising administering to said subject a liquid nutritional composition comprising

(a) a carbohydrate component which comprises from 60 to 75% of the total caloric content of said composition;

(b) a lipid component which comprises from 10 to 20% of the total caloric content of said composition; and

(c) a dietary nitrogen component which comprises from 15 to 25% of the total caloric content of said composition, wherein said dietary nitrogen component comprises from 20 to 30% by weight free amino acids, from 60 to 75% by weight hydrolyzed casein, and from 5 to 15% by weight intact caseinate protein based on total weight of said dietary nitrogen component.

26. The method of claim 25 wherein said carbohydrate component comprises about 65% of the total caloric content of said composition.

27. The method of claim 25 wherein said lipid component comprises about 15% of the total caloric value of said composition.

28. The method of claim 25 wherein said lipid component comprises a mixture of medium chain triglycerides and soybean oil.

29. The method of claim 25 wherein said lipid component comprises about 26% polyunsaturated fat, 11% monounsaturated fat, and 63% saturated fat based on total weight of said lipid component.

30. The method of claim 25 wherein said lipid component comprises about 3%

linolenic acid and about 22% linoleic acid based on total weight of said lipid component.

31. The method of claim 25 wherein said dietary nitrogen component comprises about 20% of the total caloric content of said composition.

32. The method of claim 25 wherein said dietary nitrogen component comprises about 26% by weight free amino acids, about 65% by weight hydrolyzed casein, and about 9% by weight intact caseinate protein.

33. The method of claim 25 wherein said hydrolyzed casein has a degree of hydrolysis of 25 to 35%.

34. The method of claim 33 wherein said hydrolyzed casein has a pH of 6.8 to 7.2.

35. The method of claim 25 wherein said free amino acids comprise 25 to 35% by weight branched-chain amino acids.

36. The method of claim 25 wherein said dietary nitrogen component comprises arginine at a level providing about 2% of the total caloric content of said composition.

37. The method of claim 25 wherein the ratio of grams of nitrogen:calories is about 1:125.

38. The method of claim 37 wherein the ratio of grams of nitrogen to non-nitrogen calories is about 1:100.

39. The method of claim 25 wherein said free amino acids comprises, based on total weight of said free amino acids:

L-Histidine	6-7%
L-Isoleucine	7-8%
L-Leucine	14-16%
L-Lysine	6-7%
L-Methionine/L-Cystine	3-5%
L-Phenylalanine/L-Tryptophan	8-9%
L-Threonine	3-4%
L-Tyrosine	0.5-1.5%
L-Valine	7-8%
L-Alanine	2-3%
L-Arginine	9-11%
L-Aspartic Acid	5-6%
L-Glutamine/L-Glutamic Acid	18-19%
Glycine	1-2%
L-Proline	8-9%
L-Serine	4-5%
TOTAL	100%

40. The method of claim 25 wherein said composition has been sterilized by heat treatment and sealed in an aseptic container.

41. The method of claim 40 wherein said heat treatment comprising heating said composition to about 100°C or greater for about 20 minutes or longer.

42. The method of claim 20 wherein said composition is in the form of a stable, aqueous emulsion.

43. The method of claim 25 wherein said composition is in the form of a stable, aqueous emulsion.

44. The method of claim 25 wherein said nutritional composition comprises, based on weight percent:

	%
DEIONIZED WATER	76.31161
HYDROLYZED CORNSTARCH	15.66936
CASEIN HYDROLYSATE	3.86737
MEDIUM CHAIN TRIGLYCERIDES	0.90625
SOYBEAN OIL	0.60957
SODIUM CASEINATE	0.45831
POTASSIUM CITRATE	0.40068
L-ARGININE	0.31418
L-LEUCINE	0.30553
CALCIUM PHOSPHATE TRIBASIC	0.15765
L-ISOLEUCINE	0.14910
CELLULOSE GEL	0.12559
L-VALINE	0.09898
SODIUM ASCORBATE	0.06052
CITRIC ACID	0.06948
HYDROXYLATED SOY LECITHIN	0.07940
MAGNESIUM CHLORIDE	0.07718
L-METHIONINE	0.07492
SODIUM CITRATE	0.03176
CALCIUM CARRAGEENAN	0.03178
CHOLINE CHLORIDE	0.03131
L-TRYPTOPHAN	0.02654
TAURINE	0.02223
CELLULOSE GUM	0.02223
POTASSIUM CHLORIDE	0.01687
L-CARNITINE	0.00926
ZINC SULFATE	0.00259
NIACINAMIDE	0.00278
FERROUS SULFATE	0.00275
CALCIUM PANTOTHENATE	0.00183
COPPER GLUCONATE	0.00062
MANGANESE SULFATE	0.00049
PYRIDOXINE HYDROCHLORIDE	0.00037
THIAMINE HYDROCHLORIDE	0.00034
BETA CAROTENE	0.00030
VITAMIN A PALMITATE	0.00028
RIBOFLAVIN	0.00024
BHA/BHT	0.00012
FOLIC ACID	0.00005
CHROMIC ACETATE	0.000042
BIOTIN	0.000041
SODIUM MOLYBDATE	0.000031
ALPHA TOCOPHERYL ACETATE	0.000031
POTASSIUM IODIDE	0.000013
SODIUM SELENITE	0.000013
PHYTONADIONE (VITAMIN K1)	0.000006
CYANOCOBALAMIN (VITAMIN B12)	0.000001
CHOLECALCIFEROL (VITAMIN D3)	0.000001

45. The method of claim 25 wherein said nutritional composition is administered enterally.

46. The method of claim 25 wherein said nutritional composition is administered to treat trauma, surgery, irradiated bowel, pancreatitis, inflammatory bowel disease or post operative malnutrition.

ABSTRACT

Liquid nutritional composition comprising, based on total caloric content, from 60 to 75% carbohydrate component, 10 to 20% lipid component and 15 to 25% dietary nitrogen component, wherein the dietary nitrogen component comprises from 20 to 30% by weight free amino acids, 60 to 75% by weight hydolyzed casein and 5 to 15% by weight intact caseinate protein based on total weight of the dietary nitrogen component.